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Ripple Marks

The Story Behind the Story BY CHERYL LYN DYBAS

THE GULF OF MAINE: BETWEEN A ROCK AND A HARD PLACE?

Slack Tide for Seabirds

To understand the shore, it is not enough to catalogue its life. Understanding comes only when we can sense the long rhythms of earth and sea that sculptured its land forms and produced the rock and sand of which it is composed; when we can sense with the eye and ear of the mind the surge of life beating always at its shores—blindly, inexorably pressing for a foothold.

—Rachel Carson, *The Edge of the Sea*

Blindly pressing for a foothold is exactly what Brian Benedict and I are doing on this foggy afternoon, 42 kilometers off the coast of Maine.

Benedict is the deputy director of the Maine Coastal Islands National Wildlife Refuge, 52 islands scattered across the blue-black frigid waters of the northern Gulf of Maine. On a map of the gulf, which extends from the crooked arm of Cape Cod to the outstretched hand of Nova Scotia's Cape Sable, the islands look like skipped stones that somehow came to rest atop the waves.

But these rocks are far from smooth. They

stand like sentinels, their craggy granite faces inviting—if you're a seabird. For hundreds upon hundreds of Atlantic puffins, guillemots, razorbills, and other birds of the open ocean, the welcome mat is out. The birds spend their summers on the islands, raising the next generation there. Publicly owned islands like Matinicus Rock support more than half the global nesting population of 16 ocean bird species, according to *The State of the Birds 2011: Report on Public Lands and Waters*.

On this unseasonably cool, 10°C June day, Benedict has anchored the refuge's 8.5-meter-research vessel just off Matinicus Rock. We bob in the swells. "You need a floatcoat for the next step," says Benedict. A floatcoat is a long-sleeved life jacket padded with insulating fabric. "It will keep you alive for a while in this cold ocean," Benedict explains, "and in the very unlikely event of a water landing—off the side of the boat."

Ungainly as loons taking flight, we clamber into a small zodiac that ferries us the last few meters to shore. I look straight up a granite

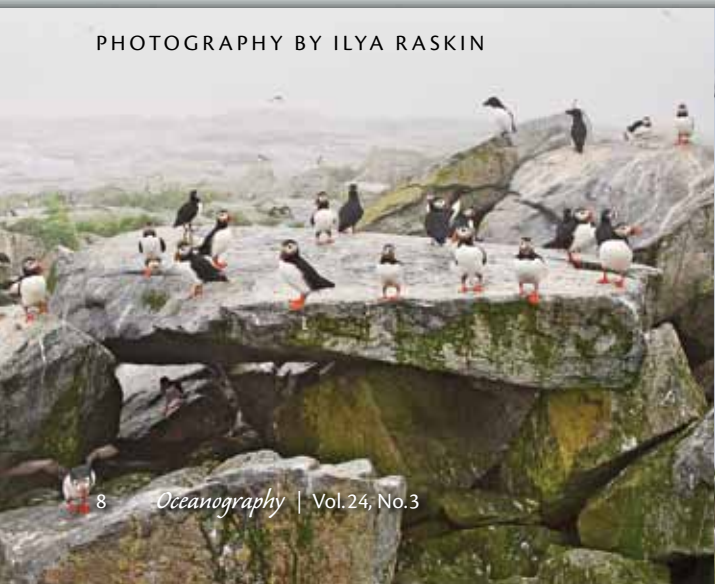
cliff. My gaze drifts meter by meter along an old wooden railway, its rockweed-covered planks stretching from the waterline to a lighthouse perched high above. The railway once carried supplies up and down the steep edge. Now as then, it's also the only way on and off the island.

"We're stepping out of the boat and onto those slick cross-boards," says Benedict, pointing to a section of railway that has almost disappeared under the swells. "It's slack tide, so we don't have much time before it turns. After that it's impossible to get ashore." At low tide, exposed rocks near the railway's end are too jagged for the zodiac to navigate.

The Gulf of Maine has the greatest vertical tidal range on Earth. Tides in Canada's Bay of Fundy in the far north are almost 17 meters, and have been measured at 21.6 meters. The tidal range at Matinicus Rock is lower, but still high at a few meters or more.

I put a foot over the gunwale. And begin sliding under the wood slats, scrambling to find a toehold. Then a new threat looms, this

PHOTOGRAPHY BY ILYA RASKIN



time from above.

Common terns, hundreds of which nest on the island, are no welcoming committee. "They like to dive-bomb 'intruders,'" warns Benedict, "so you might want to keep your head low." I wonder how 350 pairs of puffins, 375 pairs of razorbills, 1,800 pairs of Arctic and common terns, 1,000 pairs of laughing gulls, and many other birds survive on this 22-acre rock in the middle of nowhere.

Therein lies the island's secret, says ornithologist Steve Kress of the National Audubon Society and Cornell University. "All these birds are here because of the lack of predators this far out to sea. Along with fishing that's fantastic in the surrounding waters, Matinicus Rock and islands like it are prime real estate for seabirds."

Kress is widely known for his efforts to return Atlantic puffins to their former nesting sites on Maine islands. Puffins and other seabirds once bred in huge colonies along the North Atlantic, or boreal, coast. Early explorers penned accounts of the colonies' astonishing sizes.

The settlers that followed found it easy to figure out which islands had breeding seabirds. Willing to scale the islands' rocky walls, they collected eggs from nests and shot adult birds for food and fish bait. As the millinery trade grew in the eighteenth century, the feathers of many seabirds became so valuable that whole colonies disappeared. A flightless seabird of the boreal coast, the great auk, had no defense against feather collectors and fishers. By 1850, the last great auk had been killed.

Seabirds were finally protected by

the Migratory Bird Treaty Act of 1918.

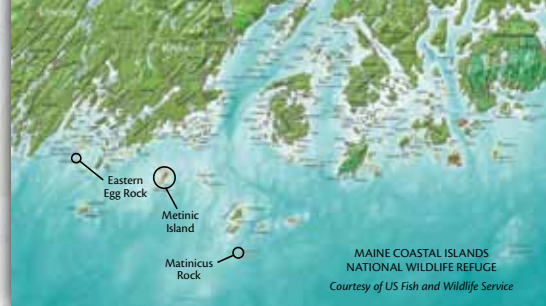
Populations on offshore islands began to recover. Even today, though, they're shadows of what they once were.

To offer the birds a hand, Kress began to transplant puffins from Newfoundland's Great Island to Eastern Egg Rock off Maine in 1973. In 1981, puffins finally produced a chick on Eastern Egg. "After more than 100 years of absence, puffins are again nesting there," says Kress, whose "Project Puffin" is supported by the National Audubon Society. Today, Eastern Egg Rock has 123 pairs of puffins vying for space on seven acres.

Kress's team and that of the Maine Coastal Islands National Wildlife Refuge work together in a cooperative program to restore seabird populations to islands such as Matinicus Rock. Their efforts foster research like that of Sarah Spencer, a graduate student at the University of Massachusetts, Amherst, who's studying when and where puffins forage for food.

Spencer attached small temperature-depth recorders to metal leg bands on Matinicus Rock puffins, then recaptured the birds a week or two later to access the data. The puffins made almost 60 percent of their dives for fish between 4:00 a.m. and 8:00 a.m. and between 4:00 p.m. and 8:00 p.m. each day. They averaged 276 dives per day—per puffin. The dives were less than 15-meters deep, with the maximum dive 40.7 meters. Average foraging site temperature was a chilly 11°C.

Are they catching their usual fish stock, herring? The answer, says Benedict, isn't clear. "Our field crews are seeing a lot of



birds—including terns, which we can easily watch on the islands—coming back with butterfish. When herring are hard to find, we start seeing butterfish. Overall, they're less nutritious." Schools of herring may be naturally scarce in one area but plentiful in another; sometimes, however, they're overfished by trawling vessels.

Closer to shore (and easier to land on) is Metinic, a 330-acre island that's eight kilometers from the mainland. With its crescent-shaped pebble beach and saltbox house above, Metinic has an uncanny resemblance to the island featured in the 1994 movie "Secret of Roan Inish," filmed along the coast of Ireland.

Whether off the coast of Ireland or Maine, seabirds face similar challenges.

"We've forever lost the great auk, and the sea mink, from the Gulf of Maine," says biological oceanographer Lew Incze of the University of Maine, "and maybe other species as well. Overharvesting, pollution, invasive species, climate change. All have affected—and will continue to affect—marine life in the Gulf of Maine and other regions of the sea."

Incze led the Gulf of Maine program of the international Census of Marine Life, which ended a decade-long effort last year. "Even in the well-studied gulf, there may be several



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thousand species waiting to be identified,” muses Incze. “Who lives in the Gulf of Maine, and what are they doing? We don’t yet have all the answers, even about the species we do know.”

Researchers Charlie Walsh and Jennifer Wiacek, who work for the Maine Coastal Islands refuge, are conducting studies on Metinic that

should help. “One of the big projects here and on other Maine islands is productivity monitoring, or finding out how many chicks survive to fledging age,” says Walsh. For tern chicks, that happens at about 15 days old.

To track productivity, explains Walsh as we carefully walk through a tern colony to count nests and eggs camouflaged against bare ground, “we fence off about 10 percent of the nests in small plots. Right now we have five plots, two for Arctic terns and three for common terns, with 59 nests packed into a very small space.”

The number of terns in the plots correlates to the overall species ratio for the colony. Data from productivity monitoring on Metinic, Matinicus Rock, and islands like Petit Manan will be used to calculate survival and growth rates for the chicks. Last year, on average, common terns fledged 0.85 chicks per nest and Arctic terns 0.32 chicks per nest.

Common terns have a shorter migration, allowing them to invest more energy in chick-rearing. In contrast, Arctic terns are famous for their long journey; they fly from North Atlantic breeding grounds to the Antarctic and back again each year. The 19,000 kilometer migration—each way—allows the birds to see two summers every year, and more daylight than any other creature on the planet.

While seabirds are summering on Metinic, say Walsh and Wiacek, they need to be able to feed their chicks well. The biologists have attached radio transmitters to five Arctic terns and five common terns to learn how far the birds fly to find food, and how long it takes them to succeed.

If scientists can establish where seabirds fish, the results will help protect offshore feeding grounds and allow biologists to track changes in these “hotspots.” An immediate concern, says Walsh, is the wind turbines springing up along the Atlantic coast. “More consideration needs to be given to where they’re placed.”

As he and Wiacek duck another tern bold enough to graze Walsh’s head, I face into the winds that swirl around Metinic. What would it be like, I wonder, to flap seabird wings and lift off into the mist, feathers touched with seaspray, then follow an ancient path across the waves to piscine treasure?

To see with the eye and ear of the mind the surge of life where wind and wave and fish meet? A place that, to us, at least for now, remains over the far horizon.



ABOVE. Brian Benedict, deputy director of the Maine Coastal Islands National Wildlife Refuge, at the helm. RIGHT. Old wooden railway. Photos courtesy of Kirk M. Rogers



Ornithologist Steve Kress of the National Audubon Society and Cornell University with the birds he’s helped bring back. Photo courtesy of Bill Scholtz/Project Puffin



Morning on Plum Island Sound. Parker River National Wildlife Refuge director Graham Taylor (left) and park ranger Chris Husgen (right) check on the marshes.



Low Tide on a Great Marsh

On the sands of the sea's edge, especially where they are broad and bordered by unbroken lines of wind-built dunes, there is a sense of antiquity that is missing from the young rock coast of New England.

—Rachel Carson, *The Edge of the Sea*

Miles and miles south of Metinic Island and Matinicus Rock, the land softens. Here at Plum Island, Massachusetts, a 13-kilometer-long barrier island, granite melts into sand dunes, rockweed becomes salt marsh grasses.

It's early morning, and I'm once again aboard a small boat, now with Graham Taylor, director of the Parker River National Wildlife Refuge, much of which lies along the southern tip of Plum Island, and Chris Husgen, park ranger at the refuge. Before us lies the Great Marsh—its bright green, gold-tipped *Spartina* grasses splayed as far as the eye can see.

Plum Island stands before the Parker, Rowley, and Ipswich Rivers, protecting them from the pounding waves of the open Atlantic. The Great Marsh encompasses the three estuaries, then extends south to enfold the Essex and Annisquam Rivers, in all, a huge wedge of northeastern Massachusetts.

Plum Island's main defense is its 15-meter-high sand dunes; they form a dune field that borders the sea for 10 kilometers. Primary foredune and crest become primary backdune, then hollow or swale. Secondary dune and crest, a line of guards, finally give up their watch where sand turns into salt marsh. Behind the dunes is a lagoon, Plum Island Sound, typical of Atlantic Coast barrier island formations.

"Plum Island, a wild and fantastical sand beach, is thrown up by the joint power of winds and waves into the thousand wanton figures of a snow drift," wrote New England historian Joshua Coffin in 1845.

Massachusetts settlers and explorers like the Coffin family, and Captain John Smith two centuries earlier, had their own power—to change the landscape by clear-cutting coastal forests. Forest removal had a significant effect on coastal marshes such as the Great Marsh, according to Matthew Kirwan of the University of Virginia in Charlottesville. Kirwan collected and dated sediment cores from the Great Marsh estuary. His analysis suggests that the marsh formed within the past few hundred years, likely because of upstream deforestation.

Scientists had believed that East Coast marshes dated to 4,000 or so years ago, when rising sea levels slowed and marshes and deltas accreted around the globe. But at least one marsh doesn't fit the bill: Plum Island. Soon after huge forest tracts were cut down in Massachusetts, extensive erosion followed, says Kirwan. Sediment was then carried by rivers toward the coast, where plants took root in the soil, ultimately forming marshes.

So far, Kirwan has studied only Plum Island, but he believes that "many of the marshes along the coast of North America are in fact a relict feature of nineteenth century land-use change."



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Along the water with Taylor and Husgen, we can almost visualize the process. Tall trees are visible for miles inland. A boat launch where we confer about the imminent low tide is surrounded by deep mud, muck that may have begun to form centuries ago.

Husgen recommends that we quickly putter into a grass-lined channel and out to open water to view the marsh, then return before we're left high and dry by the outgoing tide. Taylor agrees, and we're off, zooming across Plum Island Sound, past Grape Island, where a hermit once lived (and his ghost may still dwell), and toward Middle Ground, a sandy islet smack in the middle of the sound. Fishing boats ply Plum Island Sound's gray-blue waters for striped bass and bluefish. Blinds for autumn waterfowl hunting dot its shoreline.

"Great Marsh and Plum Island Sound owe their existence to the beach and its dunes," says Taylor. "They're barriers to the effects of nor'easters and hurricanes, among other ecosystem services. Once, farmers harvested salt hay from *Spartina* marsh grasses. Today, we still depend on the marsh and the sound for the nutrients that fuel fisheries, and the entire food web, here."

Some of Plum Island's smallest creatures—piping plovers—are among its largest beneficiaries. Piping plovers are the only shorebirds that nest along the sandy beaches of the boreal coast. The birds are listed as a threatened species in Massachusetts. Plum Island is, for a piping plover, plum territory.

During plover breeding season, Parker River National Wildlife Refuge closes a long stretch of beach to the public. Taylor and refuge biologist Nancy Pau carefully take me into the off-limits sections. "Be mindful of where you step," Pau warns. "The nests are well hidden."

Within hours of hatching, young plovers start to forage, bobbing as they run, then quickly stop, stab into the beach, and swallow insects and marine worms. Gradually, the birds develop the plaintive bell-like whistle that gives them their name. The sound is often heard before the plovers are visible.

As if on cue, one piping plover family appears, seemingly out of nowhere, along the tideline. Although we try to follow, dried seaweed and other wrack crunching under our feet, the birds easily outrun us. The last we see or hear of the plovers is their tinkling whistle.

"Piping plovers are with us until autumn, when they migrate south," says Taylor. "Then Plum Island seems to go strangely silent for a time."

"For centuries, our fortunes, and that of the plovers, have been intertwined with those of the island and the marsh. We're working to make sure that Plum Island and the Great Marsh will be here long into the future."

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High Tide for an Offshore Island

The physical facts of the American Atlantic coast are such that an observer of its life has spread before him or her, almost with the clarity of a well-conceived scientific experiment, a demonstration of the modifying effect of tides, surf, and currents. Here the zones of life created by the tides have the simple graphic force of a diagram.

—Rachel Carson, *The Edge of the Sea*

Between Massachusetts and Maine, some 16 kilometers off the New Hampshire coast, lies the rocky archipelago of the Isles of Shoals. Appledore Island, the largest of the nine islands at 95 acres, is home to the Shoals Marine Laboratory (SML), a seasonal marine field station operated since 1973 by Cornell University and the University of New Hampshire (UNH).

SML offers students, primarily those at undergraduate and high school levels, the opportunity to “get their hands wet doing oceanography for a summer,” says its director, marine ecologist William

Bemis of Cornell. From Sandpiper Beach to Larus Ledge, Siren’s Cove to Devil’s Dance Floor, those who enroll in SML’s June-through-August courses learn about conservation biology; marine invertebrates; whales, sharks, and seals; field ornithology; wildlife forensics; underwater research; sustainable fisheries; and other ocean subjects.

Spawning the next generation of oceanographers, says Bemis, “is all about location, location, location. The Gulf of Maine is a siren call to students for the study of species, from harbor seals, to sea urchins, to sandpipers.”

Bemis makes research on SML sound easy, but decades of hard work, including his, have gone into preserving the island and rendering it accessible.

John Kingsbury, SML’s first director, wrote about the challenges of constructing the offshore lab in his 1991 book *Here’s How We’ll Do It*. “Before the second World War, the white laboratory coat of the microbiologist or the cellular physiologist attracted the imaginations of many college-bound high schoolers. Following the war, the luster of the lab coat dimmed a bit. Suddenly, diving tanks became an emblem of research and the oceans were touted as the last unexplored earthly frontier of science.”

Kingsbury found that colleges were unprepared to provide firsthand experience in oceanography, however. “The only sound basis for a successful career in marine science is an unyielding, hot-burning itch to know more about things marine, and a gut feeling that the itch will last a lifetime,” Kingsbury wrote.

How does an undergraduate assess his or her marine itch before making that fateful graduate school decision? he asked. “A quiet inland classroom far from the sea is not the best place. Book learning alone is certainly not the best launching. The need for a new marine field facility and the rightness of the Isles of Shoals for such an undertaking came together like two powerful magnets.”

Today, SML is known nationally and internationally for the sea of opportunities it offers. “We call it the ‘Learning Island,’” says Bemis.

The island’s solid gold reputation gleams in the Gulf of Maine sun. It’s a testament to SML directors from Kingsbury to Bemis, and to the oceanographers from Cornell, UNH, and other institutions who offer their time and skill to fledge the next generation—not of Atlantic puffins or piping plovers or Arctic terns—but of marine scientists.

For the Gulf of Maine she loved so well, Rachel Carson would be proud.



Willy Bemis, director of the Shoals Marine Laboratory, with students aboard the research vessel *John M. Kingsbury*, named for the lab’s first director. Photo courtesy of Jan Factor



Photo courtesy of Allied Whale

Beyond the Tide

The sense of a powerful presence felt but not seen, its nearness made manifest but never revealed.

—Rachel Carson, *The Sea Around Us*

Humpback Whale Catalog #0700, she’s called.

Better known as “Siphon,” she was first sighted in 1988 in the Gulf of Maine. Siphon has been photographed there almost every year since. Here, she’s pictured with the third of five of her known calves, “Canine” (right, Humpback Catalog #8447), born in 2004. Siphon’s sighting consistency has made her a celebrity with whale-watchers in the northern Gulf of Maine. Individual humpbacks receive their names from particular photo-identification features. At an annual “naming party,” titles are suggested and petitioned.

An extensive catalog of humpback whales is maintained by marine scientists like Sean Todd, director of Allied Whale, College of the Atlantic in Bar Harbor, Maine. Allied Whale was founded in 1972 to conduct research on conservation of marine mammals and their habitats. While the group’s studies are primarily based in the Gulf of Maine, its efforts extend north to Canada, across the Atlantic to the British Isles, and south to the Cape Verde Islands, South America, and Antarctica.

An understanding of the inner workings of the Gulf of Maine—whether from whales or whelks—also may help marine life in waters thousands of miles away.